SCHEME AND SYLLABUS FOR
TWO YEAR FULL TIME P.G. PROGRAMME
UNDER AICTE MODEL CURRICULUM

M.Tech.
(Computer Networks and Information Security)

DEPARTMENT OF INFORMATION TECHNOLOGY
CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)
HYDERABAD-500 075.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
AICTE Model Curriculum (with effect from 2019-20)
M.Tech. (IT-CNIS) (REGULAR)

SEMESTER– I

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1		Program Core-1	3	-	3	30	70	3
2		Program Core-2	3	-	3	30	70	3
3		Program Elective-1	3	-	3	30	70	3
4		Program Elective-2	3	-	3	30	70	3
5		Research Methodology and IPR	2	-	2	25	50	2
6		Audit Course-1	2	-	-	-	50	Non-Credit
PRACTICALS								
7		Laboratory-1 (Based on Core)	-	4	-	50	-	2
8		Laboratory-2 (Based on Core/Elective)	-	4	-	50	-	2
TOTAL			**16**	**08**	**-**	**245**	**380**	**18**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
AICTE Model Curriculum (with effect from 2019-20)
M.Tech. (IT-CNIS) (REGULAR)

SEMESTER-II

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1		Program Core-3	3	-	3	30	70	3
2		Program Core-4	3	-	3	30	70	3
3		Program Elective-3	3	-	3	30	70	3
4		Program Elective-4	3	-	3	30	70	3
5		Audit Course-2	2	-	-	-	50	Non-Credit
PRACTICALS								
6		Laboratory-3 (Based on Core)	-	4	-	50	-	2
7		Laboratory-4 (Based on Core/Elective)	-	4	-	50	-	2
8	19IT C106	Mini Project with Seminar	-	4	-	50	-	2
TOTAL			**14**	**12**	**-**	**270**	**330**	**18**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
AICTE Model Curriculum (with effect from 2020-21)
M.Tech. (IT-CNIS) (REGULAR)

SEMESTER–III

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1		Program Elective-5	3	-	3	30	70	3
2		Open Elective	3	-	3	30	70	3
PRACTICALS								
3	19IT C107	Dissertation/Phase-I	-	20	-	100	-	10
TOTAL			6	20	-	160	140	16

SEMESTER–IV

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per Week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
PRACTICALS								
1	19IT C108	Dissertation/Phase-II	-	32	Viva-Voce	100	100	16
TOTAL			-	32	-	100	100	16

L: Lecture T: Tutorial D: Drawing P: Practical
CIE-Continuous Internal Evaluation SEE-Semester End Examination

Total No. of Credits: 68

LIST OF COURSES

S.No	Code	Course	Credits
Program Core Courses			
1.	19MT C101	Computational Number Theory	3
2.	19IT C101	Cryptography and Network Security	3
3.	19IT C102	Adhoc and Sensor Networks	3
4.	19IT C103	Advanced Algorithms	3
5.	19ME C103	Research Methodology and IPR	2
Program Elective-1, Elective-3 and Elective-5 Courses (without Lab)			
6.	19IT E101	Biometric Security	3
7.	19IT E102	Cloud Computing	3
8.	19IT E103	Database Security	3
9.	19IT E104	Digital Forensics	3
10.	19IT E105	Distributed Databases	3
11.	19IT E106	Ethical Hacking	3
12.	19IT E107	Intrusion Detection	3
13.	19IT E108	Mobile Security	3
14.	19IT E109	Secure Software Engineering	3
Program Elective-2 and Elective-4 Courses (with Lab)			
15.	19IT E110	Big Data Analytics	3
16.	19IT E111	Blockchain Technology	3
17.	19IT E112	Computational Intelligence	3
18.	19IT E113	Data Science	3
19.	19IT E114	Distributed Systems	3
20.	19IT E115	Internet of Things	3
Audit Course – 1 and 2			
21.	19EG A101	English for Research Paper Writing.	0
22.	19CE A01	Disaster Mitigation and Management	0
23.	19EE A101	Sanskrit for Technical Knowledge	0
24.	19EC A101	Value Education	0

25.	19EG A102	Indian Constitution and Fundamental Rights	0
26.	19IT A101	Pedagogy Studies	0
27.	19EG A103	Stress Management by Yoga	0
28.	19EG A104	Personality Development Through Life's Enlightenment Skills	0
Open Elective Courses			
29.	19CS O101	Business Analytics	3
30.	19ME O102	Introduction to Optimization Techniques	3
31.	19CE O101	Cost Management of Engineering Projects	3
32.	19ME O101	Industrial Safety	3
33.	19ME O103	Composite Materials	3
34.	19EE O101	Waste to Energy	3
Labs, Seminars & Projects			
Laboratory-1 and Laboratory-3 (Based on Core Courses)			
35.	19IT C104	Cryptography and Network Security Lab	2
36.	19IT C105	Advanced Algorithms Lab	2
Laboratory-2 and Laboratory-4 (Based on Elective-2 and Elective-4 Courses)*			
37.	19IT E116	Big Data Analytics Lab	2
38.	19IT E117	Blockchain Technology Lab	2
39.	19IT E118	Computational Intelligence Lab	2
40.	19IT E119	Data Science Lab	2
41.	19IT E120	Distributed Systems Lab	2
42.	19IT E121	Internet of Things Lab	2
Seminar and Projects			
43.	19IT C106	Mini Project with Seminar	2
44.	19IT C107	Dissertation/Phase-I	10
45.	19IT C108	Dissertation/Phase-II	16

*** Lab courses for Laboratory-2 and Laboratory-4 must be in one-to-one correspondence with the Elective courses opted in Program Elective-2 and Elective-4, respectively.**

19MT C101

COMPUTATIONAL NUMBER THEORY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize with linear congruences and Chinese remainder theorem.
2. To know Fermat's little theorem, and Euler's extension of it.
3. To deal with applications of Fermat and Euler theorems.
4. To facilitate learning of relevance of number theory to coding theory.
5. To introduce basics of cryptography.

Course Outcomes: Upon completing this course, students will be able to:

1. Apply number theory concepts to cryptography.
2. Solve some of the divisor problems.
3. Understand the importance of Euler's phi function in RSA crypto system.
4. Appreciate the importance of larger primes in coding theory.
5. Apply the theory of congruences to derive some of powerful theorems in number theory.

UNIT-I

Divisibility and Primes : Division Algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, fundamental theorem of arithmetic, infinitude of primes. Distribution of primes, twin primes, Goldbach conjecture, Fermat and Mersenne primes, Primality testing and factorization.

UNIT–II

Congruences, Congruences with a Prime-Power Modulus : Modular arithmetic, Linear congruences, Simultaneous linear congruences, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem (with non-coprime moduli), Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

UNIT–III

Euler's Function and RSA Cryptosystem, Units Modulo an Integer: Definition of Euler function, examples and properties, Multiplicative property of Euler's function, RSA cryptography, The group of units modulo an integer, primitive roots, Existence of primitive roots.

UNIT-IV

Quadratic Residues and Quadratic Forms: Quadratic residues, Legendre symbol, Euler's criterion, Gauss lemma, law of quadratic reciprocity, Quadratic residues for prime-power moduli and arbitrary moduli.

UNIT-V

Binary quadratic forms, equivalent forms, Discriminant, principal forms, positive definite forms, indefinite forms, Representation of a number by a form-examples, Reduction of Positive definite forms, reduced forms, Number of proper representations, automorph, class number.

Text Book:

1. G.A. Jones, J.M. Jones, "Elementary Number Theory", Springer UTM, 2007.

Suggested Reading:

1. Niven, H.S. Zuckerman & H.L. Montgomery, "Introduction to the Theory of Numbers", Wiley, 2000.
2. D. Burton, "Elementary Number Theory", McGraw-Hill, 2005.

19IT C101

CRYPTOGRAPHY AND NETWORK SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide fundamental concepts of computer security and cryptography.
2. To impart knowledge on symmetric and Asymmetric key cryptography algorithms.
3. To familiarize with Hash functions and digital signatures for Data Integrity.
4. To deal with key management and IP Security.
5. To facilitate learning on Transport and Electronic mail security.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand Security Requirements for various organizations.
2. Implement symmetric and asymmetric cryptography algorithms.
3. Describe Hash functions and digital signatures for Data Integrity.
4. Learn various aspects of key management and IP Security.
5. Identify Security Protocols and methods to provide solutions for a specific Security Problem.

UNIT-I

Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

Block Ciphers and the Data Encryption Standard: Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis and Block Cipher Design Principles.

UNIT-II

Advanced Encryption Standard: AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example.

Public Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm.
Other Public-Key Cryptosystems: Diffie- Hellman Key Exchange, ElGamal Cryptographic System, Elliptical Curve Cryptography.

UNIT-III
Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm and SHA-3.
Message Authentication Codes Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC **Digital Signatures**: Digital Signatures Properties and Requirements, Digital Signature Standard.

UNIT-IV
Key Management and Distribution: Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.
IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT-V
Transport –Level Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Transport Layer Security, HTTPS, Secure Shell.
Electronic Mail Security: Pretty Good Privacy, S/MIME, Domain Key Identified Mail.
User Authentication: Remote User-Authentication Principles, Kerberos, Federated Identity Management.

Text Books:
1. William Stallings, "Cryptography and Network Security Principles and Practice", Sixth Edition, Pearson, 2014.
2. Dr.V.K.Jain, "Cryptography and Network Security", First Edition, Khanna Book Publishing, 2013.

Suggested Reading:
1. Behrouz A Forouzan, "Cryptography and Network Security", TMH, 2010.

2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill 2003.
3. V.K Pachghare, "Cryptography and Information Security", Second Edition, PHI Learning 2015.

Web Resources:

1. https://nptel.ac.in/courses/106105162/
2. https://swayam.gov.in/courses/4955-cryptography

19IT C102

ADHOC AND SENSOR NETWORKS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce principles and protocols of cellular networks, WLANs and PANs.
2. To provide knowledge about routing and transport layer protocols over wireless networks.
3. To familiarise with characteristics, applications and routing protocols for MANETs.
4. To facilitate learning of TCP over adhoc networks and QoS issues in MANETs.
5. To impart knowledge about architecture of wireless sensor networks, MAC layer support and routing protocols for MANETs.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the operating principles of cellular networks, wireless LANs and PANs.
2. Illustrate routing and transport layer protocols over wireless networks.
3. Comprehend characteristics, applications and routing protocols for MANETs.
4. Analyse TCP and QoS solutions for adhoc networks.
5. Describe the architecture of wireless sensor networks, MAC layer support and routing protocols in MANETs.

UNIT-I

Introduction: Issues in Mobile computing, Overview of wireless telephony: Cellular concept, GSM, System Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security, GPRS, **Wireless LAN:** IEEE 802.11 Standard, Architecture, services, HIPERLAN, Ad-hoc Network, Blue Tooth.

UNIT-II

Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunnelling and encapsulation,

Optimizations, Reverse tunnelling, IPv6, IP micro-mobility support, Dynamic host configuration protocol, **TCP over Wireless Networks:** Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit /Fast Recovery, Transmission/ Timeout Freezing, Selective Retransmission, Transaction Oriented TCP,**WAP**: WAP Architecture, WDP, WTLS, WTP, WSP, WML, WML Script, WAE, WTA.

UNIT-III

Introduction to Ad-hoc Networks: Characteristics of MANETs, Applications of MANETs and challenges of MANET, **Routing in MANETs:** Topology based routing protocols-Proactive routing, reactive routing, hybrid routing, Position based routing protocols, Signal stability based routing, Power Aware Routing, Associativity based routing, QoS based routing, **Broadcasting, Multicasting and Geocasting**: Broadcast storm- Broadcasting in a MANET, Flooding generated broadcast storm, rebroadcasting schemes, Issues in providing multicast in a MANET, Multicast Routing protocols, Geocast routing protocols.

UNIT-IV

TCP over Ad-Hoc: TCP protocol overview: TCP basics, Header format, congestion control, Round trip time estimation, TCP and MANETs: Effect of partitions on TCP, Impact of lower layers on TCP, TCP Solutions for Ad hoc networks: Mobility related, Fairness related solutions

QoS Issues in Ad-hoc Networks: QoS parameters in Ad-hoc networks, Issues and challenges in providing QoS in Ad-hoc Wireless networks, Classification of QoS solutions, MAC layer and Network Layer solutions.

UNIT-V

Basics of Sensors and Applications: Introduction, applications, Empirical energy consumption, Sensing and communication range, localization scheme, clustering of sensor nodes, Architecture of wireless sensor networks, Network life time, physical layer, MAC layer, Design Issues, MAC protocols, The sensor-MAC, Routing layer- Directed diffusion, Sequential assignment routing, Minimum cost forwarding algorithm, Energy aware routing, coherent and non-coherent processing.

Text Books:

1. Carlos de Morais Cordeiro, Dharma Prakash Agrawal, "AdHoc and Sensor Networks: Theory and Applications", Second Edition, World Scientific Publishers, 2011.
2. Jochen Schiller, "Mobile Communications", Second Edition, Prentice Hall of India, Pearson Education, 2014.

Suggested Reading:

1. William Stallings, "Wireless Communications and Networks", Second Edition, Prentice Hall of India, Pearson Education, 2004.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons, Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
3. Prasant Mohapatra, Srikanth Krishnamurthy, "Ad-Hoc Networks Technologies and Protocols", Springer, Springer International Edition, 2009.
4. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", John Wiley & Sons, Inc., Publication, 2007.

Web Resource:

1. https://nptel.ac.in/courses/106105160/1

19IT C103

ADVANCED ALGORITHMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce asymptotic notation for representing Algorithmic complexity.
2. To deal with various algorithmic design approaches.
3. To familiarise with basic, advanced data structures and their applications.
4. To facilitate learning of algorithms related to network flow, text processing and computational geometry.
5. To impart knowledge about number theory and cryptography.

Course Outcomes: Upon completing this course, students will be able to:

1. Analyse time and space complexities of algorithms.
2. Select suitable algorithmic strategy for solving real world problems.
3. Design solutions using appropriate data structures for a given problem.
4. Formulate solutions to problems on network flows, text data and computational geometry.
5. Understand number theory and cryptographic computations.

UNIT-I

Algorithm Analysis: Asymptotic Notation, Amortization.
Basic Data Structures: Stacks and Queues, Lists, Trees, Priority Queues, Heaps.
Search Trees and Skip Lists: Binary Search Trees, AVL Trees, Splay Trees, Red-Black Trees, Skip Lists.

UNIT-II

Fundamental Techniques: The Greedy Method, Divide-and-Conquer, Dynamic Programming.
Graphs: The Graph Abstract Data Type, Data Structures for Graphs, Graph Traversal, Directed Graphs.

UNIT-III

Weighted Graphs: Single-Source Shortest Paths, All-Pairs Shortest Paths, Minimum Spanning Trees.

Network Flow and Matching: Flows and Cuts, Maximum Flow, Maximum Bipartite Matching, Minimum-Cost Flow.

UNIT-IV

Text Processing: Strings and Pattern Matching Algorithms, Tries, Text Compression, Text Similarity Testing.

Number Theory and Cryptography: Fundamental Algorithms involving numbers, Cryptographic Computations, Information Security Algorithms and Protocols.

UNIT-V

Computational Geometry: Range Trees, Priority Search Trees, Quadtrees and k-DTrees, Convex Hulls.

Text Books:

1. M T Goodrich, R Tamassia, "Algorithm Design-Foundations, Analysis, and Internet Algorithms", John Wiley, 2002.
2. E Horowitz S Sahni, S Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, University Press, 2007.

Suggested Reading*:*

1. Aho, A V Hopcraft, Ullman J D, "The Design and Analysis of Computer Algorithms", Pearson Ed, 2007.
2. Hari Mohan Pandy, "Design Analysis and Algorithms", University Science Press, 2009.
3. Cormen, Lieserson, Rivest, "Introduction to Algorithms", Second Edition, PHI, 2003.

Web Resources:

1. http://ww3.algorithmdesign.net/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2008/study-materials/
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-introduction-to-algorithms-sma-5503-fall-2005/video-lectures/

19ME C103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT - III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

19IT E101

BIOMETRIC SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce concepts and methodologies for biometric recognition.
2. To familiarize biometrics, biometric equipment and standards applied to security.
3. To facilitate learning about major forms of automated personal identification systems, with emphasis on fingerprint, face and iris recognition.
4. To acquaint with biometric computing knowledge and methods.
5. To deal with basic biometrics systems using case studies.

Course Outcomes: Upon completing this course, students will be able to:

1. Demonstrate the knowledge of physical, biological science and engineering principles underlying the biometric systems.
2. Understand biometric systems at the component level.
3. Identify issues associated with the design and implementation of biometric systems.
4. Describe multi biometric systems.
5. Understand the role of biometrics in ensuring security.

UNIT-I

Introduction: Person Recognition, Biometric Systems, Biometric Functionalities, Biometric System Errors, the Design Cycle of Biometric Systems, Applications, Security and Privacy Issues.

UNIT-II

Fingerprint Recognition: Introduction, Friction Ridge Pattern, Fingerprint Acquisition, Feature Extraction, Matching, Fingerprint Indexing, Fingerprint Synthesis, Palmprint.

UNIT-III

Face Recognition: Introduction, Image Acquisition, Face Detection, Feature Extraction and Matching.

Iris Recognition: Introduction, Design of an Iris Recognition System, Image Acquisition, Iris Segmentation, Iris Normalization, Iris Encoding and Matching, Iris Quality, Performance Evaluation.

UNIT-IV

Multibiometrics: Introduction, Sources of Multiple Evidence, Acquisition and Processing Architecture, Fusion Levels.

UNIT-V

Security of Biometric Systems: Introduction, Adversary Attacks, Attacks at the User Interface, Attacks on Biometric Processing, Attacks on the Template Database.

Text Book:

1. Anil K. Jain, Arun A. Ross, Karthik Nandakumar, "Introduction to Biometrics", Springer, 2011.

Suggested Reading:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio (Eds) "Biometric Systems Technology, Design and Performance Evaluation", Springer-Verlag London Limited, 2005.
2. Julian Ashbourn, "Guide to Biometrics for Large-Scale Systems Technological, Operational and User-Related Factors", Springer-Verlag London Limited, 2011.
3. Charles A. Shoniregun, Stephen Crosier, "Securing Biometrics Applications", Springer, 2008.

Web Resources:

1. https://nptel.ac.in/courses/106104119/
2. https://www.coursera.org/lecture/usable-security/biometric-authentication

19IT E102

CLOUD COMPUTING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarise with basic concepts of cloud computing and enabling technologies.
2. To introduce about Auto-Scaling, capacity planning and load balancing in cloud.
3. To impart knowledge on issues related to security, privacy and compliance.
4. To introduce cloud management standards and programming models.
5. To deal with the basics of Service oriented architecture and databases in cloud.

Course Outcomes: After successful completion of the course, student will be able to:

1. Understand the basic concepts of different cloud computing and its techniques.
2. Learn the issues related to scaling and load balancing.
3. Identify the security and compliance issues in clouds.
4. Analyse portability and interoperability issues and cloud virtualization.
5. Understand the importance of SOA and databases.

UNIT-I

Introduction: Limitations of the Traditional Computing Approaches, Three Layers of Computing, Three Layers in Traditional Computing, the End of Traditional Computing, Influences behind Cloud Service Adoption. Benefits and challenges: Origin of the Term 'Cloud Computing', Early Initiatives, Utility Computing, Metering and Billing in Cloud, Separation of Data Center Operation, Benefits of Cloud Computing, Challenges of Cloud Computing, How Cloud Computing Addresses Business Challenges, Ethical Issues in Cloud Computing, Cloud Computing: Network as Computer, Role of Web Service, Role of API, Ubiquitous Cloud, Confusion Between Cloud and Internet, Cloud computing services, Resource Virtualization, Resource pooling, sharing and provisioning.

UNIT-II

Scaling in cloud: Introduction to Scaling, Scaling in Traditional Computing, Scaling in Cloud Computing, Foundation of Cloud Scaling, Scalable Application , Scaling Strategies in Cloud, Auto-Scaling in Cloud, Types of Scaling, Performance and Scalability, the Resource Contention Problem, Cloud Bursting: A Scenario of Flexible Scaling, Scalability is a Business Concern, **Capacity Planning:** Capacity Planning, Capacity Planning in Computing, Capacity Planning in Cloud Computing, Approaches for Maintaining Sufficient Capacity, Steps for Capacity Planning, **Load Balancing**: Load Balancing , Importance of Load Balancing in Cloud Computing, Load Balancing in Cloud, Goals of Load Balancing, Categories of Load Balancing, Load Balancing Algorithms, Case study on Google cloud and Amazon Elastic Compute Cloud (EC2), File System and Storage.

UNIT-III

Content Delivery Network: CDN Service Operations, Evolution of CDN, Advantages of CDN, Disadvantages of CDN, CDN Service Provider, Security Reference Model, **Security Issues:** Cloud security, threats to Cloud Security, Infrastructure Security, Information Security, Identity Management and Access Control, Cloud Security Design Principles, Cloud Security Management Frameworks, Security-as-a-Service, Privacy and Compliance Issues.

UNIT-IV

Portability and Interoperability Issues: Challenges in the Cloud, The Issues in Traditional Computing, Addressing Portability and Interoperability in Cloud, Portability and Interoperability Scenarios, Machine Imaging or Virtual Machine Image, Virtual Appliance, Difference between Virtual Machine Image and Virtual Appliance, Open Virtualization Format (OVF), Cloud Management and a Programming Model Case Study, Popular Cloud Services.

UNIT-V

Service-Oriented Architecture: The Pre-SOA Era ,Role of SOA in Cloud Computing, Service-Oriented Architecture, Goal of System Designing, Service Represents Business Functionality, Open Standard Implementation, Benefits of SOA , SOA and Cloud Computing. **Enterprise architecture and SOA**: Enterprise Software, Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Text Books:

1. Sandeep Bhowmik, “Cloud Computing”, Cambridge University Press, 2017.

2. Gautam Shroff, "Enterprise Cloud Computing - Technology, Architecture, Applications", Cambridge University Press, 2016.

Suggested Reading:

1. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Elsevier, 2012.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.
3. Ronald L. Krutz, Russell Dean Vines "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley- India, 2010.

Web Resource:

1. https://nptel.ac.in/coursesnptel_download.php?subjectid=106105167

19IT E103

DATABASE SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the security aspects of databases.
2. To familiarise with various Security Models.
3. To facilitate understanding of protection mechanisms and security in Software Design.
4. To introduce Statistical Database Protection and Intrusion Detection System.
5. To acquaint with security models for new generation database systems.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand security issues in databases.
2. Describe various Security Models.
3. Comprehend various Security Mechanisms and methods to ensure Secure Software Design.
4. Understand the methods to ensure security using statistics and IDS.
5. Describe security models for new generation database systems.

UNIT-I

Introduction: Introduction to Databases, Security Problems in Databases, Security Controls Conclusions.

Security Models: Introduction Access Matrix Model, Take-Grant Model, Acten Model, PN Model.

UNIT-II

Security Models: Hartson and Hsiao's Model, Fernandez's Model, Bussolati and Martella's Model for Distributed databases, Bell and LaPadula's Model, Biba's Model, Dion's Model, Sea View Model, Jajodia and Sandhu's Model, The Lattice Model for the Flow Control.

UNIT-III

Security Mechanisms: Introduction User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms, Isolation Security

Functionalities in Some Operating Systems, Trusted Computer, System Evaluation Criteria.

Secure Software Design: Introduction, A Methodological Approach to Security. Software Design, Secure Operating System, Design Secure DBMS Design, Security Packages, Database Security Design.

UNIT-IV

Statistical Database Protection and Intrusion Detection Systems: Introduction Statistics Concepts and Definitions, Types of Attacks, Inference Controls evaluation Criteria for Control Comparison, Introduction IDES System, RETISS System, ASES System, Discovery.

UNIT-V

Models for the Protection of New Generation Database Systems: Introduction, A Model for the Protection of Frame Based Systems, A Model for the Protection of Object-Oriented Systems, SORION Model for the Protection of Object-Oriented Databases, A Model for the Protection of New Generation Database Systems, The Orion Model Jajodia and Kogan's Model, A Model for the Protection of Active Databases.

Text Book:

1. S. Castano, M. Fugini, G. Martella, P. Samarati, Database Security, Addison-Wesley, 1994.

Suggested Reading:

1. Ron Ben Natan, "Implementing Database Security and Auditing, Elsevier", Indian reprint 2006.
2. Zoran Pavlovic, Maja Veselica, "Oracle Database 12c Security Cookbook", Packt Enterprise, 2016.
3. Alfred Basta, Melissa Zgola , Database Security", Cengage Learning, 2011.
4. Michael Gertz, Sushil Jajodia, "Handbook of Database Security: Applications and Trends", Springer, 2008.

Web Resources:

1. https://docs.oracle.com/cd/B19306_01/server.102/b14220/security.htm
2. https://security.berkeley.edu/resources/best-practices-how-articles/system-application-security/database-hardening-best-practices

19IT E104

DIGITAL FORENSICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide basics of Computer forensics.
2. To introduce various measures for evidence collection.
3. To familiarise with forensic analysis and validation.
4. To introduce methods for processing crime and incident scenes.
5. To impart knowledge about the role of E-mail, Mobile devices and System in investigations.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand fundamentals of computer forensics.
2. Describe various methods to preserve digital evidence.
3. Comprehend forensic analysis and validation methods.
4. Understand the methods for processing crime scenes.
5. Recognise the importance of E-mail, Mobile devices and operating system in investigations.

UNIT-I

Computer Forensics Fundamentals: Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

Types of Computer Forensics Technology: Types of Military Computer Forensics Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensics Technology.

Computer Forensics Evidence and Capture: Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution.

UNIT-II

Evidence Collection and Data Seizure: Collect Evidence, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody.

Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene, Computer Evidence Processing Steps, Legal Aspects of Collecting Preserving Computer Forensics Evidence.

Computer Image Verification and Authentication: Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation.

UNIT-III

Computer Forensics Analysis and Validation: Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data–Hiding Techniques, Performing Remote Acquisitions.

Network Forensics: Network Forensics Overview, Performing Live Acquisitions, Developing Standard Procedures for Network Forensics, Using Network Tools: Examining the Honeynet project.

UNIT-IV

Processing Crime and Incident Scenes: Identifying Digital Evidence, Collecting Evidence in Private-Sector Incident Scenes, Processing Law Enforcement Crime Scenes, Preparing for a Search, Securing a Computer Incident or Crime Scene, Seizing Digital Evidence at the Scene, Storing Digital Evidence, Obtaining a Digital Hash, Reviewing a Case.

Current Computer Forensics Tools: Evaluating Computer Forensic Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.

UNIT-V

E-Mail Investigations: Exploring the Role of E-Mail in Investigation, Exploring the Role of the Client and Server in E-Mail, Investigating E-Mail Crimes and Violations, Understanding E-Mail Servers, Using Specialized E-Mail Forensic Tools.

Cell Phone and Mobile Device Forensics: Understanding Mobile Device Forensics, Understanding Acquisition Procedures for Cell Phones and Mobile Devices.

Working with Windows and DOS Systems: Understanding File Systems, Exploring Microsoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption, Windows Registry, Microsoft Startup Tasks, MS-DOS Startup Tasks, Virtual Machines.

Text Books:

1. John R. Vacca, "Computer Forensics: Computer Crime Investigation", First Edition, Charles River Media, Laxmi Publications, 2015.
2. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Fourth Edition, Course Technology, Cengage Learning, 2010.

Suggested Reading:

1. Keith J. Jones, Rechard Bejtlich, Curtis W.Rose, "Real Digital Forensics: Computer Security and Incident Response", Addison-Wesley Pearson, 2005.
2. Tony Sammes, Brain Jenkinson, "Forensic Compiling, A Practitioner's Guide", Springer, 2007.
3. Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", 3rd Edition, Academic Press, 2011.

Web Resources:

1. https://www.cs.nmt.edu/~df/lectures.html
2. http://www.cyberforensics.in/
3. https://www.ncdrc.res.in/
4. http://www.sleuthkit.org/

19IT E105

DISTRIBUTED DATABASES

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the basic concepts, architecture and design of Distributed databases.
2. To impart knowledge on translation of global queries and query optimization.
3. To familiarize concepts of transaction management and concurrency control.
4. To introduce concepts of reliability and distributed database administration.
5. To deal with the preliminaries of client-server architecture and database interoperability issues**.**

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the fundamentals of distributed databases and its architectures.
2. Analyse localization, fragmentation of global queries and query optimization.
3. Describe concurrency control mechanisms.
4. Understand reliability and distributed database administration.
5. Explain client-server architecture and database interoperability issues.

UNIT-I

Distributed Databases: Features of Distributed versus Centralized Databases, Principles of Distributed Databases.

Levels of Distribution Transparency: Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases, Distributed Database Design.

UNIT-II

Translation of Global Queries to Fragment Queries: Equivalence transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

UNIT-III

The Management of Distributed Transactions: A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions.

Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

UNIT-IV

Reliability: Basic Concepts, Non blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart.

Distributed Database Administration: Catalog Management in Distributed Databases, Authorization and Protection.

UNIT-V

Distributed Object Database Management Systems: Architectural Issues, Alternative Client/Server Architectures, Cache Consistency, Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects.

Database Interoperability: Database Integration, Scheme Translation, Scheme Integration, Query Processing, Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues, Transaction Management,

Transaction and Computation Model, Multidatabase Concurrency Control, Multidatabase Recovery, Object Orientation and Interoperability, Object Management Architecture, CORBA and Database interoperability, Distributed Component Object Model, COM/OLE and Database Interoperability.

Current Issues: PUSH-Based Technologies.

Text Books:

1. Stefano Ceri, Giuseppe Pelagatti, "Distributed Databases Principles & Systems", TMH, 1985.
2. M. Tamer Ozsu, Patrick Valduriez, "Principles of Distributed Database Systems", Second Edition, Pearson Education.

Suggested Reading:

1. Chhanda Ray and Ray, "Distributed Database Systems", Pearson Education India, 2009.
2. Saeed K.Rahimi, Frank S.Haug, "Distributed Database Management System-A Practical Approach", 2010, Wiley Publisher.

Web Resources:

1. http://pcbunn.cithep.caltech.edu/DistributedDatabasesPakistan.pdf
2. http://web.cs.wpi.edu/~cs561/s12/LectureHours/4-5 DistributedDBs.pdf

19IT E106

ETHICAL HACKING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the concepts of Ethical Hacking and legal issues surrounding hacking.
2. To provide deeper insight into the penetration testing tools and techniques.
3. To impart knowledge on vulnerability analysis and reverse engineering.
4. To familiarise with browser exploits and Windows memory protection.
5. To provide insight into setting trap for catching malware and tools used for malware analysis.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the Cyber Laws and the impact of hacking.
2. Demonstrate how to prepare and conduct a physical penetration.
3. Understand ethics behind hacking and vulnerability disclosure.
4. Exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.
5. Understand the core concepts related to malware, hardware and software vulnerabilities and their causes.

UNIT-I

Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure.

UNIT-II

Penetration Testing and Tools: Using Metasploit, Using BackTrack Linux Distribution, Managing a Penetration Test.

UNIT-III

Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering.

UNIT-IV

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit.

UNIT-V

Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware.

Text book:

1. Shon Harris, Allen Harper, Chris Eagle, Jonathan Ness, "Gray Hat Hacking: The Ethical Hackers' Handbook", 3rd Edition, TMH.

Suggested Reading:

1. Jon Erickson, "Hacking: The Art of Exploitation", Second Edition, SPD.
2. Sagar Rahalkar, "Metasploit for Beginners", 2017.

Web Resource:

1. iDefense SysAnalyzer: labs.idefense.com/software/malcode.php

19IT E107

INTRUSION DETECTION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce basic concepts of intrusion detection and prevention.
2. To familiarise with Network and Host based IDS.
3. To acquaint with TCP dump and IP header.
4. To facilitate learning of session fixation, Honeypots and Honeynets.
5. To impart knowledge about architectural and organisationl issues.

Course Outcomes: Upon completing this course, students will be able to:

1. Enumerate common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
2. Comprehend Intrusion Detection principles and approaches in order to improve the security posture of an enterprise.
3. Understand TCP dump and examine IP header.
4. Examine network traffic to identify threats that generate unusual traffic flows.
5. Implement models to monitor the security of the system.

UNIT-I

Intrusion Detection and Prevention Principles: Uses of IDPS Technologies, Key Functions of IDPS Technologies, Common Detection Methodologies, Types of IDPS Technologies.

Other Detection Approaches: Misuse detection(Pattern Matching, Rule based Techniques, State based Techniques, Techniques based on Data Mining), Anomaly Detection (Advanced Statistical Models, Rule based techniques, Biological Models, Learning Models) Specification based Detection , Hybrid Detection.

IDPS Technologies: Components and Architecture, Security Capabilities, Management.

UNIT-II

Network based IDPS: Networking Overview, Components and architecture.

Host-Based IDPS: Components and architecture.

Wireless IDPS: Wireless networking overview, components and architecture, capabilities, management.
Network Behavior Analysis System: Components and architecture, security capabilities, management.

UNIT-III
Introduction to TCP Dump and TCP: TCP Dump, Introduction to TCP, TCP Gone awry.
Fragmentation: Theory of Fragmentation, Malicious Fragmentation.
Automated and Manual Response: Automated Response, Honey Pot, Manual Response.
Examining IP Header Field: Insertion and Evasion Attacks, IP Header Fields, MF Flag.

UNIT-IV
Session Fixation: Session Fixation Attack Process, Session Fixation Process Tree, Session Fixation Countermeasures, Session Fixation vs. Session Hijacking.
Honeypots and Honeynets: Introduction, Architecture of Honeypot, Physical vs Virtual Honeypots, Honeypot vs Honeynet.
Business Case for Intrusion Detection: Management Issues, Threats and Vulnerabilities.

UNIT-V
Architectural Issues: Events of Interest, Limits to Observation, Human Factors Limit Detects, Severity, Countermeasures, Calculating Severity, Sensor Placement and outside firewall.
Organizational issues: Defining Risk, Threat and Risk management.
Unified Threat Management: Introduction, Different Inspection Methods and their Benefits, High Level Diagram of UTM.

Text Books:

1. Karen Scarfone, Peter Mell, "Guide to Intrusion Detection and Prevention System (IDPS) National Institute of Standards and Technology", Technology Administration, U.S. Department of Commerce, First Edition, 2007.
2. Stephen Northcutt, Judy Novak, "Network Intrusion Detection", Third Edition, New riders.

Suggested Reading:

1. Peter Szor, "The Art of Computer Virus Research and Defense", Symantec Press
2. Markus Jakobsson and Zulfikar Ramzan, "Crime ware, Understanding New Attacks and Defenses", Symantec Press, 2008.

19IT E108

MOBILE SECURITY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the security aspects of Mobile Communications.
2. To familiarise with security aspects in GSM and 3G networks.
3. To facilitate learning security aspects of adhoc networks and internetworking.
4. To impart knowledge about ways to secure mobile and satellite services.
5. To acquaint with security measures for mobile voice and multimedia communications.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand security issues in Mobile Communications.
2. Describe various security issues in GSM and 3G Networks.
3. Comprehend various security mechanisms in adhoc networks and internetworking.
4. Explain methods to ensure secure mobile and satellite services.
5. Describe security aspects for mobile voice and multimedia communications.

UNIT-I

Threats, Hacking, and Viruses in Mobile Communications: Introduction, Basics of Mobile Communications, Wireless Vulnerabilities and Threats, Attacks in Mobile Environments, Mobile Malware, Prevention Techniques in Mobile Systems, Intrusion Detection in Wireless Communications.

Smart Card Security: The SIM/USIM Case: Basic on Smart Cards, Smart Card and Communication, Attacks against Smart Cards, Security of Log Files in Smart Cards, Forensics and SIM/USIM Cards.

UNIT-II

Security of GSM Networks: GSM Mobility Scheme, GSM Security Mode, Basic Attacks on GSM, GSM Encryption Algorithms, Advanced Attacks on GSM, Improving GSM Security.

Security of 3G Networks: Introduction, The 3G Networks, Network Access Security, Network Domain Security, User, Application, and Visibility Domain Security, Security Functions, Security Features of 3G Networks, Attacks on 3G Networks.

UNIT-III

Security of Ad Hoc Networks: Ad Hoc Networking, Major Routing Protocols in Ad Hoc Networks, Attacks against Ad Hoc Networks, Securing Ad Hoc Networks, Authentication in Ad Hoc Networks, Key Management, Intrusion Detection in Ad Hoc Networks.

Inter-System Roaming and Internetworking Security: Introduction, Roaming, Roaming Authentication and Key Agreement, Inter-Provider Roaming within the GSM and UMTS, Man-in-the-Middle Attack on UMTS, Inter-Provider Handover, The Security Solutions, Attacks against Inter-Provider Handover.

UNIT-IV

Securing Mobile Services: Basics on E-Services, M-Services Discovery, Basic Examples of M-Services and Challenges, M-Government, M-Commerce, M-Service Message Protection Mechanisms, Securing Registry for M-Services

Security of Satellite Services: Examples of Satellite Networks, Reliable Transport in Mobile Satellite Communications, Packet Routing in Non-GEO Networks, Mobility and Location Management in Satellite Networks, Attacks against Satellite Networks, Securing Satellite Networks.

UNIT-V

Security of Mobile Voice Communications: Introduction, Basics on VoIP, Security Issues in VoIP, Mobility Issues, The Security Threats to Mobile VoIP, Attacks on the Key Exchange, Secure Real-Time Protocol, Securing Mobile VoIP.

Security of Multimedia Communications: Introduction, Transmission Issues of Mobile Multimedia, Securing Copyright in Mobile Networks, Major Watermarking Techniques, Attacks against Mobile Multimedia, Countermeasures against Watermarking Attacks, Security of Mobile Multimedia Multicasting Schemes.

Text Book:

1. Noureddine Boudriga, "Security of Mobile Communications", First Edition, CRC Press, 2010.

Suggested Reading:

1. Himanshu Dwivedi, Chris Clark, David Thiel, "Mobile Application Security", McGraw Hill, 2010.
2. Iosif I. Androulidakis, "Mobile Phone Security and Forensics: A Practical Approach", Second Edition, Springer Publications, 2012.
3. Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier Publications, 2011.
4. Vijay Kumar Velu, "Mobile Application Penetration Testing", Packt Publications, 2016.

Web Resource:

1. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/security/mobile-device-security.html

19IT E109

SECURE SOFTWARE ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the concepts of secure software development.
2. To familiarize security properties for developing secure software systems.
3. To impart knowledge on Designing secure software architectures.
4. To facilitate learning secure coding and testing considerations through SDLC.
5. To acquaint with software security framework and practices.

Course Outcomes: Upon completing this course, students will be able to:

1. Evaluate secure software engineering problems, including the specification, design, implementation, and testing of software systems.
2. Understand, analyse and specify security properties of software.
3. Analyse software solutions to security problems using various paradigms.
4. Describe secure software testing using SDLC.
5. Understand software security framework and practices.

UNIT-I

Introduction: Software assurance and software security, Threats to software security, sources of software insecurity, Benefits of detecting software security, **Managing Secure Software Development**: Which security strategy, A Risk Management Framework for Software Security, Software Security Practices in the Development Life Cycle.

UNIT-II

Defining Properties of Secure Software: Core Properties of Secure Software, Influential Properties of Secure Software, How to influence the security properties of software: The Defensive Perspective, The Attacker's perspective, **Assert and Specify Desired Security Properties**: Building a Security Assurance Case, A Security assurance Case Example, Incorporating Assurance Cases into the SDLC, Related Security Assurance and Compliance Efforts, Maintaining and Benefiting from Assurance Cases.

UNIT-III

Secure Software Architecture and Design: The Critical Role of Architecture and Design, Issues and Challenges, Software security practices for architecture and design: Architectural risk analysis, **Software Security Knowledge for Architecture and Design**: security principles, security guidelines, and attack patterns, secure design through threat modelling.

UNIT-IV

Secure Coding and Testing: code analysis- source code review, coding practices, static analysis, software security testing: Contrasting Software Testing and Software Security Testing, functional and risk based testing, **Security Testing Consideration through SDLC**: Unit testing, Testing libraries and executable files, Integration and system testing, sources of Additional Information on Software Security Testing.

UNIT-V

Governance and Managing for more Secure Software: Introduction, Governance and Security, Adopting an Enterprise Software Security, Framework, Security Is Enough, Security and Project Management: Project Scope, Project Plan, Resources, Estimating the Nature and Duration of Required Resources, Project and Product Risks, Measuring Software Security,

Maturity of Practice: Protecting Information, Audit's Role, Operational Resilience and Convergence, A Legal View, A Software Engineering View, Exemplars.

Text Books:

1. Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, "Software Security Engineering: A Guide for Project Managers", Addison Wesley, 2008.
2. Ross J Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", Second Edition, Wiley, 2008.

Suggested Reading:

1. Howard, M., LeBlanc, D., "Writing Secure Code", Second Edition, Microsoft Press, 2003.
2. Jason Grembi, "Secure Software Development: A Security Programmer's Guide", First Edition, 2008.
3. Gary R. McGraw, "Software Security: Building Security", Addison-Wesley Software Security Edition, 2006.

Web Resources:

1. https://www.oreilly.com/library/view/software-security-engineering/
2. https://www.checkmarx.com/2016/02/26/security-testing-sdlc-beginners-guide/
3. https://resources.infosecinstitute.com/intro-secure-software-development-life-cycle/#gref

19IT E110

BIG DATA ANALYTICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce big data and HDFS.
2. To impart knowledge on Mapper and Reducer.
3. To provide the concepts of NoSQL and MongoDB.
4. To introduce programming tools PIG and HIVE in Hadoop echo system.
5. To facilitate learning of Spark with machine learning applications.

Course Outcomes: Upon completing this course, students will be able to:

1. Perform data processing in Hadoop framework.
2. Build applications using MapReduce.
3. Model the data using NoSQL and MongoDB.
4. Explore big data applications using Pig and Hive.
5. Develop machine learning solutions in Spark.

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UNIT-I

Introduction to Big Data: Big Data Important, Big Data Solution, Big Data Use Cases: IT for IT Log Analytics, the Fraud Detection Pattern, Social Media Pattern.
The Hadoop Distributed Files system: The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability, The Command-Line Interface, Basic File system Operations, Hadoop File systems, Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the File System API, Writing Data, Directories, Querying the File system, Deleting Data, Data Flow, Anatomy of a File Read, Anatomy of a File Write.

UNIT-II

MapReduce: What is Map reduce, Architecture of map reduce.
How MapReduce Works: Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures, Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort, The Map Side, The Reduce

Side, **MapReduce Types and Formats:** MapReduce Types, The Default MapReduce Job, Input Formats, Input Splits and Records, Text Input, Output Formats, Text Output, Developing a MapReduce Application.
Hadoop Ecosystem and YARN: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

UNIT-III
No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases, **Working Mechanisms of Mongo DB**: Overview, Advantages, Environment, Data Modelling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation

UNIT-IV
Pig: Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice.
Hive: Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

UNIT-V
Spark: Spark and its Purpose, Components of the Spark Unified Stack, Batch and Real-Time Analytics with Apache Spark, Resilient Distributed Dataset, Scala (Object Oriented and Functional Programming)
Machine Learning with Spark: Designing a Machine Learning System, Obtaining, Processing and Preparing Data with Spark, Building a Recommendation Engine with Spark, Building a Classification Model with Spark, Building a Regression Model with Spark and Building a Clustering Model with Spark.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly Media Inc, 2015.
2. Nick Pentreath, "Machine Learning with Spark", First Edition, Packt Publishing, 2015.

Suggested Reading:

1. Thilinagunarathne, "Hadoop MapReduce v2 Cookbook", Second Edition, Packet Publishing, 2015.
2. Chuck Lam, Mark Davis, Ajit Gaddam, "Hadoop in Action", Manning Publications Company, 2016.
3. Alex Holmes, "Hadoop in Practice", Manning Publications Company, 2012.
4. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.
5. Edward Capriolo, Dean Wampler, Jason Rutherglen, "Programming Hive", O'Reilly Media Inc, 2012.

Web Resources:

1. http://www.planetcassandra.org/what-is-nosql
2. https://stanford.edu/~rezab/sparkworkshop/slides/xiangrui.pdf
3. https://class.coursera.org/datasci-001/lecture

19IT E111

BLOCKCHAIN TECHNOLOGY

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce blockchain technology.
2. To discuss about bit coin crypto currency system.
3. To impart knowledge about building and deploying blockchain applications.
4. To facilitate learning of using blockchain for applications other than crypto currency.
5. To explore platforms such as Ethereum, Hyperledger Fabric to build applications on blockchain.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand blockchain technology.
2. Describe the working of bit coin crypto currency.
3. Build and deploy blockchain application for on premise and cloud based architecture.
4. Integrate ideas from various domains and implement them using blockchain technology in different perspectives.
5. Design smart contract using Ethereum and Hyperledger Fabric frameworks.

UNIT-I

Introduction: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

UNIT-II

Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, **Proof of Work (PoW):** basic introduction, Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

UNIT-III

Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

UNIT-IV

Enterprise Application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade — Trade Finance Network, Supply Chain Financing, Identity on Blockchain

UNIT-V

Hyperledger Fabric: Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

Text Books:

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Suggested Reading:

1. Iran Bashir "Mastering Blockchain", Second Edition Paperback, 2018.
2. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
3. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing.

Web Resources:

1. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
2. https://www.hyperledger.org/projects/fabric
3. https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger

19IT E112

COMPUTATIONAL INTELLIGENCE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce intelligent systems and problem solving strategies.
2. To familiarise with propositional calculus and knowledge representation techniques.
3. To facilitate learning of expert systems and probabilistic reasoning models.
4. To impart knowledge about machine learning algorithms.
5. To introduce basics of natural language processing.

Course Outcomes: Upon completing this course, students will be able to:

1. Solve problems using State-Space Search and Control Strategies.
2. Apply inference methods in propositional logic to prove statements.
3. Understand expert systems and probabilistic reasoning models.
4. Apply classification and clustering techniques on data sets and understand the working of neural networks.
5. Understand syntax and semantics of the natural language.

UNIT-I

Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications.

Problem Solving-State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction, Game Playing: Bounded Look-ahead Strategy and use of Evaluation Functions, Alpha-Beta Pruning.

UNIT-II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to Knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT-III

Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Expert Systems vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and Tools.
Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster-Shafer Theory.

UNIT-IV

Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning. Clustering, Support Vector Machines
Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks, Radial-Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks.

UNIT-V

Advanced Knowledge Representation Techniques: Case Grammars, Semantic Web.
Natural Language Processing: Introduction, Sentence Analysis Phases, Grammars and Parsers, Types of Parsers, Semantic Analysis, Universal Networking Knowledge.

Text Books:

1. Russell, Norvig, "Artificial Intelligence - A Modern Approach", Second Edition, Pearson Edu, 2004.
2. Rich, Knight, Nair: "Artificial Intelligence", Tata McGraw Hill, Third Edition 2009.
3. Nilsson, N., "Artificial Intelligence: A New Synthesis", San Francisco, Morgan Kaufmann, 1998.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, 2011.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill, 1997.

19IT E113

DATA SCIENCE

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the fundamentals of Python.
2. To familiarise with Numpy, Pandas and various file formats.
3. To facilitate learning of data pre-processing and data visualisation.
4. To introduce data analysis and inferential statistics.
5. To impart knowledge on regression and ensemble methods.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand programming in Python.
2. Work with packages Numpy, Pandas and various file formats.
3. Apply pre-processing on raw data.
4. Visualise data and understand inferential statistics.
5. Apply machine learning algorithms for data analysis.

UNIT-I

The Way of the Program, Variables, Expressions and Statements, Functions, Conditionals and Recursion, Functions, Iteration, Strings, Lists, Dictionaries, Tuples.

UNIT-II

NumPy Basics: Arrays and Vectorized Computation, Getting Started with Pandas, Data Loading, Storage, and File Formats.

UNIT-III

Data Cleaning and Preparation, Data Wrangling: Join, Combine, and Reshape, Making Sense of Data through Advanced Visualization, Data Aggregation and Group Operations.

UNIT-IV

Data Analysis Examples: Gov Data from Bitly, MovieLens Dataset, Food Database, Election Commission Database, Inferential Statistics, Uncovering Machine Learning.

UNIT-V

Performing Predictions with Linear Regression, Pushing Boundaries with Ensemble Models, Applying Segmentation with k-means Clustering.

Text Books:

1. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.
2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", Second Edition, O'Reilly Media, 2017.
3. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:

1. Joel Grus, "Data Science from Scratch-First Principles with Python", O'Reilly Media, 2015
2. John V. Guttag, "Introduction to Computation and Programming Using Python– with Application to Understanding Data", Second Edition, The MIT Press, 2016.
3. Alberto Boschetti, Luca Massaron, "Python Data Science Essentials: A Practitioner's Guide Covering Essential Data Science Principles, Tools, and Techniques", Third Edition, 2018.

Web Resources:

1. https://www.kaggle.com
2. https://www.dataschool.io/
3. https://www.linkedin.com/in/randylaosat

19IT E114

DISTRIBUTED SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To present the basic concepts and architectures of distributed systems.
2. To introduce processes and threads.
3. To familiarize with communication and synchronization in distributed systems.
4. To provide understanding of consistency, replication and fault tolerance in distributed systems.
5. To facilitate learning of security aspects in distributed environments.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand various models and architectures of distributed systems.
2. Illustrate use of threads and describe RPC and RMI in distributed systems.
3. Describe various naming and synchronization mechanisms in distributed systems.
4. Comprehend Consistency, Replication and Fault Tolerance in distributed systems.
5. Understand security aspects and compare various distributed object-based systems

UNIT-I

Introduction: Definition of A Distributed System; Goals-Making Resources Accessible, Distribution Transparency, Openness, Scalability, Pitfalls; Types of Distributed Systems- Distributed Computing Systems, Distributed Information Systems, Distributed Pervasive Systems.

Architectures: Architectural Styles, System Architectures- Centralized Architectures, Decentralized Architectures, Hybrid Architectures; Architectures versus Middleware-Interceptors, General Approaches to Adaptive Software, Discussion.

UNIT-II

Processes: Threads: Introduction to Threads, Threads in Distributed Systems; Virtualization, The Role Of Virtualization In Distributed Systems, Architectures

of Virtual Machines; Clients- Networked User Interfaces, Client-Side Software for Distribution Transparency; Servers- General Design Issues, Server Clusters, Managing Server Clusters; Code Migration- Approaches to Code Migration, Migration and Local Resources, Migration in Heterogeneous Systems.

Communication: Fundamentals- Layered Protocols, Types of Communication; Remote Procedure Call- Basic RPC Operation, Parameter Passing; Asynchronous RPC, Example: DCE RPC; Message-Oriented Communication- Message Oriented Transient Communication, Message Oriented Persistent Communication, Example: IBM'S WebSphere Message-Queuing System; Stream-Oriented Communication- Support for Continuous Media, Streams and Quality of Service, Stream Synchronization; Multicast Communication, Application-Level Multicasting, Gossip-Based Data Dissemination.

UNIT-III

Naming: Names, Identifiers, and Addresses, Flat Naming, Simple Solutions, Home-Based Approaches, Distributed Hash Tables, Hierarchical Approaches; Structured Naming, Name Spaces, Name Resolution, the Implementation of a Name Space, Example: The Domain Name System; Attribute-based Naming, Directory Services

Synchronization: Clock Synchronization- Physical Clocks, Global Positioning System, Clock Synchronization Algorithms; Logical Clocks- Lamport's Logical Clocks, Vector Clocks; Mutual Exclusion-Overview, A Centralized Algorithm, A Decentralized Algorithm, A Distributed Algorithm, A Token Ring Algorithm, A Comparison of the Four Algorithms; Global Positioning of Nodes, Election Algorithms- Traditional Election Algorithms

UNIT-IV

Consistency and Replication: Introduction- Reasons for Replication, Replication as Scaling Technique; Data-Centric Consistency Models- Continuous Consistency, Consistent Ordering of Operations; Client-Centric Consistency Models- Eventual Consistency, Monotonic Reads, Monotonic Writes, Read your Writes, Writes Follow Reads; Replica Management- Replica-Server Placement, Content Replication and Placement, Content Distribution; Consistency Protocols- Continuous Consistency, Primary-Based Protocols, Replicated-Write Protocols, A Cache-Coherence Protocols

Fault Tolerance: Introduction To Fault Tolerance-Basic Concepts, Failure Models, Failure Masking by Redundancy; Process Resilience- Design Issues, Failure Masking and Replication, Agreement in Faulty Systems, Failure Detection; Reliable Client-Server Communication- Point-To-Point Communication, RPC Semantics in The Presence Of Failures; Reliable Group Communication- Basic

Reliable-Multicasting Schemes, Scalability in Reliable Multicasting, Atomic Multicast; Distributed Commit-Two-Phase Commit, Three-Phase Commit; Recovery- Introduction, Check pointing, Message Logging, Recovery-Oriented Computing.

UNIT-V

Security: Introduction to Security- Security Threats, Policies, and Mechanisms, Design Issues, Cryptography; Secure Channels- Authentication, Message Integrity and Confidentiality, Secure Group Communication, Example: Kerberos; Access Control- General Issues in Access Control, Firewalls, Secure Mobile Code, Denial of Service; Security Management- Key Management, Secure Group Management, Authorization Management.

Distributed Object-Based Systems: Architecture- Distributed Objects, Example: Enterprise Java Beans, Example- Globe Distributed Shared Objects; Processes- Object Servers, Example: The Ice Runtime System; Communication- Binding a Client to an Object, Static versus Dynamic Remote Method Invocations, Parameter Passing, Example: Java RMI, Object-Based Messaging; Naming- CORBA Object References, Globe Object References; Synchronization, Consistency and Replication- Entry Consistency, Replicated Invocations; Fault Tolerance- Example: Fault-Tolerant CORBA, Example: Fault-Tolerant Java; Security- Example: GLOBE , Security for Remote Objects.

Text Book:

1. Andrew S. Tanenbaum, Van Steen, "Distributed Systems: Principles and Paradigms", Second Edition, PHI, 2014.

Suggested Reading:

1. Colouris G., Dollimore Jean, Kindberg Tim, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2002.
2. Sunitha Mahajan, Seema Shah, "Distributed Computing", Second Edition, Oxford University Press, 2013.
3. Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, "Distributed and Cloud Computing", Morgan Kaufmann Publishers, 2012.
4. S. Ghosh, "Distributed Systems", Chapman & Hall/CRC, Taylor & Francis Group, 2010.
5. Ajay D. Kshema Kalyani, Mukesh Singhal, "Distributed Computing, Principles, Algorithms and Systems", Cambridge, 2010.

19IT E115

INTERNET OF THINGS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide an overview of Internet of Things and its enabling technologies.
2. To familiarise with Python scripting.
3. To introduce design methodologies of IoT.
4. To impart knowledge about Raspberry Pi device, its interfaces and Django Framework.
5. To explore domain specific applications of IoT.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the terminology, enabling technologies and applications of IoT.
2. Write Python Scripts.
3. Enumerate the steps involved in IoT system design methodology.
4. Develop simple IoT systems using Python and Raspberry Pi.
5. Describe domain specific applications of IoT.

UNIT-I

Introduction & Concepts: Introduction to Internet of Things: Definitions & Characteristics of IoT, Physical Design of IOT-Things in IoT, IoT Protocols, Logical Design of IOT-IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, **IOT Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates.

UNIT-II

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling, Python packages of Interest for IoT-JSON, XML, HTTPLib, URLLib, SMTPLib

UNIT-III

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-IV

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi About the Raspberry Pi board, Raspberry Pi interfaces-Serial, SPI, I2C, Other IoT Devices pcDuino, BeagleBone Black, Cubie board IoT Physical Servers and Cloud Offerings- Introduction to cloud storage models and Communication APIs, WAMP-AutoBahn for IoT, Xivelycloud for IoT Python Web Application Framework: Django Framework-Roles of Model, Template and View.

UNIT-V

Domain Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Text Book:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.

Suggested Reading:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press).
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", First Edition, Apress Publications, 2013.
3. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014.

Web Resources:

1. https://pythonprogramming.net/introduction-raspberry-pi-tutorials/
2. https://www.raspberrypi.org/documentation/usage/python/
3. https://pythonprogramming.net/django-web-development-with-python-intro/

19IT C104

CRYPTOGRAPHY AND NETWORK SECURITY LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce the fundamental concepts of computer security and cryptography.
2. To facilitate learning on Symmetric Key Algorithms.
3. To impart the knowledge of Asymmetric Cryptography Algorithms.
4. To introduce digital signatures and its applications.
5. To familiarise with hash functions for Data Integrity.

Course Outcomes: Upon completing this course, students will be able to:

1. Apply basic cryptographic techniques.
2. Generate cipher text using Symmetric Key Algorithms.
3. Implement Use Asymmetric Key Cryptography Algorithms.
4. Generate Digital Signatures using standard algorithms.
5. Implement hash functions to ensure Data Integrity.

List of Programs

1. Implement Caesar cipher
2. Implement Mono Alphabetic Cipher
3. Implement Vigenere cipher (Polyalphabetic substitution)
4. Implement Hill cipher.
5. Implement S-DES algorithm for data encryption
6. Implement RSA Asymmetric (public key and private key)-Encryption-Encryption key (e, n) & (d, n)
7. Implement Diffie-Hellman Key Exchange Protocol.
8. Generate Digital Signature using Hash Code.
9. Study of MD5 Hash function and implement the hash code using MD5.
10. Study of SHA-5 hash function and implement the hash code using SHA-5.

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Sixth Edition, Pearson, 2014.

2. Dr.V.K.Jain, "Cryptography and Network Security", First Edition ,Khanna Book publishing New Delhi 2013.

Suggested Reading:

1. Behrouz A Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2010.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.
3. V.K Pachghare, "Cryptography and Information Security", Second Edition, PHI Learning 2015.

Web Resources:

1. https://nptel.ac.in/courses/106105162/
2. https://swayam.gov.in/courses/4955-cryptography

19IT C105

ADVANCED ALGORITHMS LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To familiarise with tree structures like AVL and Red-Black.
2. To introduce different paradigms of problem solving.
3. To familiarise with graph representations and its operations.
4. To introduce Pattern Matching Algorithms and Tries.
5. To facilitate learning of algorithms on Information Security.

Course Outcomes: Upon completing this course, students will be able to:

1. Implement tree structures.
2. Solve computational problems using different design techniques.
3. Apply appropriate techniques for solving a given problem using Graphs.
4. Perform Pattern Matching for text data.
5. Implement Cryptographic techniques to ensure security.

List of Programs

1. Construct a Binary Search Tree and implement Tree Traversals.
2. Implement AVL Tree.
3. Implement Red-Black Tree.
4. Implement Task Scheduling Problem using Greedy method.
5. Implement 0-1 Knapsack Problem using Dynamic Programming.
6. Implement Graph Traversals.
7. Implement Floyd-Warshall Algorithm to compute Transitive Closure.
8. Implement Dijkstra's algorithm for the Single source shortest path problem.
9. Implement Minimal Spanning Tree Algorithms.
10. Implement Ford-Fulkerson Algorithm.
11. Implement Knuth –Morris-Pratt Pattern Matching Algorithm.
12. Implement Boyer-Moore Pattern Matching Algorithm.
13. Implement Tries.
14. Implement RSA Algorithm.
15. Implement Priority Search Trees.

Text Books:

1. Miachael T Goodrich, Roberto Tarnassia, "Algorithm Design: Foundations, Analysis, and Internet Examples ", Second Edition, John Wiley & Sons.
2. Ellis Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, University Press.

Suggested Reading:

1. Aho, A V Hopcraft, Ullman J D, "The Design and Analysis of Computer Algorithms", Pearson Education, 2007.
2. Hari Mohan Pandey, "Design Analysis and Algorithms", Firewall Media, 2008.
3. Cormen, Lieserson, Rivest, "Introduction to Algorithms", Second Edition, MIT Press, 2009.

Web Resources:

1. http://nptel.ac.in/courses/ 106101060
2. http://nptel.ac.in/courses/ 106106131

19IT E116

BIG DATA ANALYTICS LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce Hadoop Cluster setup and MapReduce.
2. To present Pig and HiveQL to process big data.
3. To impart knowledge to work with NoSQL databases.
4. To familiarise with Spark framework.
5. To facilitate learning of processing large datasets in Hadoop and visualize its results in R (RHadoop).

Course Outcomes: Upon completing this course, students will be able to:

1. Setup Hadoop cluster and develop applications using Map Reduce.
2. Write scripts using Pig to solve real world problems and queries the datasets using Hive.
3. Write NoSQL queries for large datasets.
4. Work in Spark environment.
5. Analyse and visualise applications in R language and Hadoop.

List of Programs

1. Understanding and using basic HDFS commands.
2. Word count application using Mapper Reducer on single node cluster.
3. Analysis of Weather Dataset on Multi node Cluster using Hadoop.
4. Real world case studies on Map Reduce applications.
5. Working with files in Hadoop file system: Reading, Writing and Copying.
6. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig.
7. Working with HiveQL.
8. Writing User Defined Functions in Hive.
9. Understanding the processing of large dataset on Spark framework.
10. Integrating Hadoop with other data analytic framework like R.

Text Books:

1. Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O’Reilly Media Inc, 2015.

2. Nick Pentreath, "Machine Learning with Spark", First Edition, Packt Publishing, 2015.
3. Tanmay Deshpande, "Hadoop Real-World Solutions Cookbook", Second Edition, Packt Publishing 2016.

Suggested Reading:

1. Edward Capriolo, Dean Wampler, and Jason Rutherglen, "Programming Hive", O'Reilly Media, 2012.
2. Vignesh Prajapati, "Big data Analytics with R and Hadoop", Packt Publishing, November 2013.

Web Resources:

1. https://parthgoelblog.wordpress.com/tag/hadoop-installation
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com.
5. https://doc.lagout.org/science/Artificial%20Intelligence/Machine%20learning Machine%20Learning%20with%20Spark%20%5BPentreath%202014-12-08%5D.pdf

19IT E117

BLOCKCHAIN TECHNOLOGY LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To provide conceptual understanding of blockchain technology.
2. To familiarise with blockchain based solutions to innovate and improve business processes.
3. To introduce design and architectural primitives of blockchain.
4. To present system and security aspects of blockchain.
5. To provide use cases from different application domains.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand blockchain technology.
2. Develop blockchain based solutions.
3. Write smart contract using Hyperledger Fabric and Ethereum frameworks.
4. Build and deploy blockchain applications for on-premise and cloud based architecture.
5. Develop blockchain based solutions for providing security for various application domains.

List of Programs

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.

6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan.
7. Develop an IOT asset tracking app using Blockchain. Use an IOT asset tracking device to improve a supply chain by using Blockchain, IOT devices and Node-RED.
8. Secure art using blockchain digital certificates. Node.js-based auction application can help democratize the art market.

Text Books:

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Suggested Reading:

1. Iran Bashir "Mastering Blockchain", Second Edition Paperback 2018.
2. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
3. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing.

Web Resources:

1. https://github.com/hyperledger/https://docs.docker.com/get-started/ https://console.ng.bluemix.net/docs/services/blockchain/index.html
2. https://developer.ibm.com/patterns/create-and-deploy-blockchain-network/
3. https://developer.ibm.com/patterns/create-and-deploy-blockchain-network-using-fabric-sdk-java/
4. https://console.bluemix.net/docs/containers/container index.html#container index
5. http://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/
6. http://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/
7. http://developer.ibm.com/patterns/devlop-an-iot-asset-tracking-app-using-blockchain/
8. http://developer.ibm.com/patterns/securing-art-using-blockchain-digital-certificates/

9. http://developer.ibm.com/patterns/iot-dashboards-analyze-data-blockchain-network/
10. http://developer.ibm.com/patterns/create-an-android-app-with-blockchain-integration/
11. http://developer.ibm.com/patterns/global-financing-use-case-for-blockchain/
12. http://developer.ibm.com/patterns/loyalty-points-fabric-evm/
13. http://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-blockchain/

19IT E118

COMPUTATIONAL INTELLIGENCE LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To facilitate learning of building Intelligent Agents.
2. To introduce uninformed and informed Search methods.
3. To present game playing strategies of Intelligent Agents.
4. To familiarise with Machine learning algorithms.
5. To introduce package NLTK for string processing.

Course Outcomes: Upon completing this course, students will be able to:

1. Construct intelligent agent to play games.
2. Build intelligent agent for search.
3. Making optimization and inference algorithm for model learning.
4. Implement Machine learning algorithms in a structured environment.
5. Implement string operations using package NLTK.

List of Programs

1. Implement simple Chatbot.
2. Perform uninformed search and informed search.
3. Construct a Bayesian network from given data.
4. Implement Supervised learning algorithms.
5. Implement Unsupervised learning algorithms.
6. Perform the following operations on text data:
   a. Remove punctuations from the given string.
   b. Generate string tokens.
7. Perform the following operations using NLTK tool:
   a. Remove stop words for a given passage from a text file
   b. Stemming for a given sentence
   c. POS (Parts of Speech) tagging for the give sentence
8. Classify Text data.

Text Books:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
2. Russell, Norvig, "Artificial intelligence: A Modern Approach", Pearson Education, Third Edition, 2015.

Suggested Reading:

1. Rich, Knight, Nair: "Artificial intelligence", Tata McGraw Hill, Third Edition, 2009.
2. Nicole Bauerle, Ulrich Rieder, "Markov Decision Process with Applications to Finance", Springer, 2011.
3. Nilsson. N., "Artificial Intelligence: A New Synthesis", First Edition, Morgan Kaufmann, 1998.

Web Resources:

1. https://ai.berkeley.edu/project_overview.html
2. http://aima.cs.berkeley.edu/

19IT E119

DATA SCIENCE LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce data structures in Python.
2. To familiarise with different kinds of data and file formats.
3. To gain knowledge on data preprocessing and data visualization.
4. To acquaint with supervised and unsupervised learning algorithms.
5. To explore various case studies.

Course Outcomes: Upon completing this course, students will be able to:

1. Identify appropriate data structures for storing and processing the data.
2. Work with multiple kinds of data and various file formats.
3. Preprocess raw data and visualize the data.
4. Apply supervised and unsupervised algorithms.
5. Provide solutions to real world problems using machine learning algorithms.

List of Programs

1. Demonstrate the usage of Python data structures.
2. Explore various kinds of data like time series, text, etc.
3. Perform file handling operations in Python for various file formats.
4. Apply various preprocessing techniques on any two datasets.
5. Visualise data using packages matplotlib, seaborn, etc., and provide your inference.
6. Build Classifiers and perform prediction.
7. Demonstrate various Clustering Techniques.
8. Predict if a loan will get approved or not.
9. Predict the price of a house (Boston Housing Dataset).
10. Classify text documents according to their labels.

Text Books:

1. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, O'Reilly, 2016.
2. William McKinney, "Python for Data Analysis Data Wrangling with Pandas, NumPy and IPython", Second Edition, O'Reilly Media, 2017.

3. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015.

Suggested Reading:

1. Joel Grus, "Data Science from Scratch-First Principles with Python", O'Reilly Media, 2015.
2. Rachel Schutt, Cathy O'Neil, "Doing Data Science, Straight Talk from the Frontline", O'Reilly, 2014.

Datasets:

1. https://www.kaggle.com/datasets
2. https://www.csie.ntu.edu.tw/~cjlin/libsvmtools/datasets/multilabel.html#siam-competition2007
3. https://archive.ics.uci.edu/ml/index.php

Web Resources:

1. https://www.analyticsvidhya.com/blog/2018/05/24-ultimate-data-science-projects-to-boost-your-knowledge-and-skills/
2. https://www.learndatasci.com/tutorials/data-science-statistics-using-python/
3. https://www.kaggle.com/getting-started
4. https://www.datacamp.com/community/tutorials

19IT E120

DISTRIBUTED SYSTEMS LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To facilitate learning of concepts like virtual time, agreement and consensus protocols.
2. To familiarise with various distributed architectures.
3. To introduce basics of IPC, Group communication and RPC.
4. To illustrate methods DFS and DSM.
5. To present transaction management in distributed environment.

Course Outcomes: Upon completing this course, students will be able to:

1. Design a chat server to simulate multi client server environment.
2. Implement file transfer using FTP.
3. Implement middleware using RMI.
4. Implement 2-Phase Commit Protocol in a distributed environment.
5. Demonstrate Distributed File System using NFS.

List of Programs

1. Demonstrate the TCP and UDP Communication.
2. Develop an FTP Client with a GUI interface for the access of all services.
3. Implement Chat Server Application.
4. Implement a mini DNS protocol using RMI.
5. Implement Multicasting.
6. Implement a Two-Phase Commit for distributed transaction management.
7. Understanding of working of NFS (Includes exercises on Configuration of NFS).
8. Implement thread communication in Distributed environment.
9. Implement Database Replication.
10. Create CORBA based server-client application.

Text Book:

1. Andrew S. Tanenbaum, Van Steen, “Distributed Systems”, Second Edition, PHI, 2014.

Suggested Reading:

1. Colouris, Dollimore, Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2. Sunitha Mahajan, Seema Shah, “Distributed Computing”, Oxford University Press, Second Edition, 2013.

19IT E121

INTERNET OF THINGS LAB

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Objectives:

1. To introduce Python Programming.
2. To impart knowledge about interfacing LEDs and switches.
3. To introduce different sensors.
4. To familiarise with applications using Raspberry Pi3.
5. To provide knowledge to develop IoT applications.

Course Outcomes: Upon completing this course, students will be able to:

1. Write python programs that run on Raspberry Pi3.
2. Interface LEDs and switches using Raspberry Pi3.
3. Work with Sensors and Actuators.
4. Develop IoT applications.
5. Implement simple Home automation system using Raspberry Pi3.

List of Programs

1. Switching LED on/off from Raspberry Pi Console.
2. Interfacing an LED and Switch with Raspberry Pi.
3. Interfacing a Light Sensor with Raspberry Pi.
4. Interfacing Rain Sensing Automatic Wiper System.
5. Interfacing to identify accident and send alert messages.
6. Interfacing smoke sensor to give alert message to fire department.
7. Implementation of Traffic Light System based on density, to decrease congestion.
8. Design and develop IoT Solar Power Monitoring System.
9. Design and develop Patient health monitoring system.
10. Implementation of Home Automation System using WiFi Module.

Text Book:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2014.

Suggested Reading:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to

the Internet of Things: Introduction to a New Age of Intelligence", First Edition, Academic Press, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", First Edition, Apress Publications, 2013.

Web Resources:

1. http://www.circuitbasics.com/raspberry-pi-ds18b20-temperature-sensor-tutorial/
2. https://raspberrypihq.com/making-a-led-blink-using-the-raspberry-pi-and-python/
3. https://github.com/adafruit/Adafruit_Python_DHT

19IT C106

MINI PROJECT with SEMINAR

Instruction	4 Hours per week
CIE	50 Marks
Credits	2

Course Outcomes: Upon completing this course, students will be able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the programme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of the work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

AUDIT COURSES

19EG A101

ENGLISH FOR RESEARCH PAPER WRITING

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. To understand the nuances of language and vocabulary in writing a Research Paper.
2. To develop the content, structure and format of writing a research paper.
3. To enable the students to produce original research papers without plagiarism.

Course Outcomes: Upon completing this course, students will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT –III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT-IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Book:

1. C. R Kothari, Gaurav, Garg, **Research Methodology Methods and Techniques,** New Age International Publishers. 4th Edition.

Suggested Reading:

1. Day R (2006) "How to Write and Publish a Scientific Paper**",** Cambridge University Press
2. MLA **"**Hand book for writers of Research Papers**"**, East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers**"**, Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resource:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

19CE A01

DISASTER MITIGATION AND MANAGEMENT

(M. E./ M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
CIE	0 Marks
Credits	0

Course Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: Upon completing this course, students will be able to:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. To understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective

disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT-I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and

responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, Government of India, "National disaster management plan, Part I and II",
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file\disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

19EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

Course Outcomes: Upon completing this course, students will be able to:

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures

Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram-

Text Books:

1. M Krishnamachariar, "History of Classical Sanskrit Literature", TTD Press, 1937.
2. M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students", Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015.
3. Kapail Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994.
4. "Pride of India", Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
2. Shri RamaVerma, "Vedas the source of ultimate science", Nag publishers, ISBN:81-7081-618-1, 2005

19EC A101

VALUE EDUCATION

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: Upon completing this course, students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT IV

Values in Holy Books: Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Suggested Reading:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.
2. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita", with Sanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

19EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT-I

History of making of the Indian constitutions: History, Drafting Committee (Composition & Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance": Parliament: Composition, Qualifications, Powers and Functions, Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, ayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.
Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

19IT A101

PEDAGOGY STUDIES
(Audit Course)

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
Credits	0

Course Objectives:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

19EG A103

STRESS MANAGEMENT BY YOGA

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Course Outcomes: Upon completing this course, students will be able to:

1. To understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT-I

Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT –II

Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT-III

Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT-IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Suggested Reading:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

19EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

(M. E. / M. Tech Audit Course I/II Sem - Common to all branches)

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	0 Marks
Credits	0

Course Objectives:

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom among themselves.

Course Outcomes: Upon completing this course, students will be able to:

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. To practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT-I

Neetisatakam – Holistic development of personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic development of personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of basic knowledge - Shrimad BhagawadGeeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT-V

Role of Bahgavadgeeta in the present scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Reading:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Web Resource:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

OPEN ELECTIVES

19CS O101

BUSINESS ANALYTICS

Instruction	3 hrs per week
Duration of End examination	3 hrs
Semester end examinations	70
CIE	30
Credits	3

Course Objectives:

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: Upon completing this course, students will be able to:

1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

19ME O102

INTRODUCTION TO OPTIMIZATION TECHNIQUES (OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Outcomes: Upon completing this course, students will be able to:

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queuing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT – I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

UNIT – II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT – III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward

path, Determination of critical path, duration of the project, Free float, Independent float and Total float

UNIT – IV

Queuing Theory and Inventory:: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT – V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010.

19CE O101

COST MANAGEMENT OF ENGINEERING PROJECTS (OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: Upon completing this course, students will be able to:

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and levelling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V

Budgetary Control:: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

References:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2 edition (18 October 1996)
4. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. (2004).
5. Kumar Neeraj Jha "Construction Project Management Theory and Practice", Pearson Education India; 2 edition (2015)

19ME O101

INDUSTRIAL SAFETY
(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Course Outcomes: Upon completing this course, students will be able to:

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT - I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT – II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance

department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT – III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT – V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Reading:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

19ME O103

COMPOSITE MATERIALS
(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: To make the students to learn the

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Course Outcomes: Upon completing this course, students will be able to:

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT – I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", (Vol 13) Composites, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Reading:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

19EE O101

WASTE TO ENERGY
(OPEN ELECTIVE)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Course outcomes: Upon completing this course, students will be able to:

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized

bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Reading:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

19IT C107

DISSERTATION PHASE-I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

19IT C108

DISSERTATION PHASE- II

Instruction	32 Hours per week
Duration of SEE	Viva
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

Guidelines for awarding marks in CIE:		**Max. Marks: 100**
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report in standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)Max. Marks: 100

Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce